

Appendix B

APPLICABLE TABLES AND LANGUAGE FROM STANDARDS AND RACM

Standards Tables 116-A and 116-B

TABLE 116-A DEFAULT FENESTRATION PRODUCT U-FACTORS

FRAME TYPE ¹	PRODUCT TYPE	SINGLE-PANE U-FACTOR	DOUBLE-PANE U-FACTOR ²
Metal	Operable	1.28	0.79
Metal	Fixed	1.19	0.71
Metal	Greenhouse/garden window	2.26	1.40
Metal	Doors	1.25	0.77
Metal	Skylight	1.98	1.3
Metal, Thermal Break	Operable	NA	0.66
Metal, Thermal Break	Fixed	NA	0.55
Metal, Thermal Break	Greenhouse/garden window	NA	1.12
Metal, Thermal Break	Doors	NA	0.59
Metal, Thermal Break	Skylight	NA	1.11
Nonmetal	Operable	0.99	0.58
Nonmetal	Fixed	1.04	0.55
Nonmetal	Doors	0.99	0.53
Nonmetal	Greenhouse/garden windows	1.94	1.06
Nonmetal	Skylight	1.47	0.84

¹ Metal includes any field-fabricated product with metal cladding. Nonmetal-framed manufactured fenestration products with metal cladding must add 0.04 to the listed U-factor. Nonmetal-frame types can include metal fasteners, hardware, and door thresholds. Thermal break product design characteristics are:

- The material used as the thermal break must have a thermal conductivity of not more than 3.6 Btu-inch/hr/ft²/°F,
- The thermal break must produce a gap of not less than 0.210 inch, and
- All metal members of the fenestration product exposed to interior and exterior air must incorporate a thermal break meeting the criteria in Items a. and b. above.

In addition, the fenestration product must be clearly labeled by the manufacturer that it qualifies as a thermally broken product in accordance with this standard. Thermal break values shall not apply to field-fabricated fenestration products.

²For all dual-glazed fenestration products, adjust the listed U-factors as follows:

- Subtract 0.05 for spacers of 7/16 inch or wider.
- Subtract 0.05 for products certified by the manufacturer as low-E glazing.
- Add 0.05 for products with dividers between panes if spacer is less than 7/16 inch wide.
- Add 0.05 to any product with true divided lite (dividers through the panes).

TABLE 116-B DEFAULT SOLAR HEAT GAIN COEFFICIENT

FRAME TYPE	PRODUCT	GLAZING	TOTAL WINDOW SHGC ²	
			Single-Pane	Double-Pane
Metal	Operable	Clear	0.80	0.70
Metal	Fixed	Clear	0.83	0.73
Metal	Operable	Tinted	0.67	0.59
Metal	Fixed	Tinted	0.68	0.60
Metal, Thermal Break	Operable	Clear	NA	0.63
Metal, Thermal Break	Fixed	Clear	NA	0.69
Metal, Thermal Break	Operable	Tinted	NA	0.53
Metal, Thermal Break	Fixed	Tinted	NA	0.57
Nonmetal	Operable	Clear	0.74	0.65
Nonmetal	Fixed	Clear	0.76	0.67
Nonmetal	Operable	Tinted	0.60	0.53
Nonmetal	Fixed	Tinted	0.63	0.55

² SHGC = Solar Heat Gain Coefficient.

STANDARDS SECTION 118 (d) and 118 (e)

- (d) **Installation of Insulation in Existing Buildings.** Insulation installed in an existing attic, or on an existing duct or water heater, shall comply with the applicable requirements of this subsection. If a contractor installs the insulation, the contractor shall certify to the customer, in writing, that the insulation meets the applicable requirements of this subsection.
1. **Attics.** If insulation is installed in the existing attic of a low-rise residential building, the R-value of the total amount of insulation (after addition of insulation to the amount, if any, already in the attic) shall be at least R-38 in climate zones 1 and 16; and R-30 in all other climate zones.

EXCEPTION to Section 118 (d) 1: Where the accessible space in the attic is not large enough to accommodate the required R-value, the entire accessible space shall be filled with insulation provided such installation does not violate Section 1505.3 of Title 24, Part 2.
 2. **Water heaters.** If external insulation is installed on an existing unfired water storage tank or on an existing back-up tank for a solar water-heating system, it shall have an R-value of at least R-12, or the heat loss of the tank surface based on an 80°F water-air temperature difference shall be less than 6.5 Btu per hour per square foot.
 3. **Ducts.** If insulation is installed on an existing space-conditioning duct, it shall comply with Section 605 of the CMC.
- (e) **Placement of roof/ceiling insulation.** Insulation installed to limit heat loss and gain through the top of conditioned spaces shall comply with the following:
1. Insulation shall be installed in direct contact with a continuous roof or ceiling which is sealed to limit infiltration and exfiltration as specified in Section 117, including but not limited to placing insulation either above or below the roof deck or on top of a drywall ceiling; and
 2. Insulation placed on top of a suspended ceiling with removable ceiling panels shall be deemed to have no effect on envelope heat loss; and

EXCEPTION to Section 118(e) 3: When there are conditioned spaces with a combined floor area no greater than 2,000 square feet in an otherwise unconditioned building, and when the average height of the space between the ceiling and the roof over these spaces is greater than 12 feet, insulation placed in direct contact with a suspended ceiling with removable ceiling panels shall be an acceptable method of reducing heat loss from a conditioned space and shall be accounted for in heat loss calculations.
 3. Insulation shall be installed below the roofing membrane or layer used to seal the roof from water penetration unless the insulation has a maximum water absorption of 0.3 percent by volume when tested according to ASTM Standard C 272.

STANDARDS SECTION 150 (a) and 150 (b)

Any new construction in a low-rise residential building shall meet the requirements of this Section.

(a) **Ceiling Insulation.** The opaque portions of ceilings separating conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of either Item 1 or 2 below:

1. Ceilings shall be insulated between wood-framing members with insulation resulting in an installed thermal resistance of R-19 or greater for the insulation alone.

ALTERNATIVE to Section 150 (a) 1: Insulation which is not penetrated by framing members may meet an R-value equivalent to installing R-19 insulation between wood-framing members and accounting for the thermal effects of framing members.

2. The weighted average U-factor of ceilings shall not exceed the U-factor that would result from installing R-19 insulation between wood-framing members in the entire ceiling and accounting for the effects of framing members.

(b) **Loose-fill Insulation.** When loose-fill insulation is installed, the minimum installed weight per square foot shall conform with the insulation manufacturer's installed design weight per square foot at the manufacturer's labeled R-value.

Standards Tables 151-B and 151-C

STANDARDS TABLE 151-B ALTERNATIVE COMPONENT PACKAGE C

Climate Zone	1, 16	3	4	5	6	7	8, 9	10	2, 11-13	14	15
BUILDING ENVELOPE											
Insulation minimums ¹											
Ceiling	R49	R38	R38	R38	R38	R38	R38	R49	R49	R49	R49
Wood-frame walls	R29	R25	R25	R25	R21	R21	R21	R25	R29	R29	R29
“Heavy mass” walls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
“Light mass” walls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Below-grade walls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Slab floor perimeter	R7	R7	R7	R7	R7	R7	R7	R7	R7	R7	R7
Raised floors	R30	R30	R30	R30	R21	R21	R21	R30	R30	R30	R21
Concrete raised floors	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radiant Barrier	NR	NR	REQ	NR	NR	NR	REQ	REQ	REQ	REQ	REQ
FENESTRATION											
Maximum U-factor ²	0.42	0.42	0.38	0.42	0.42	0.38	0.38	0.38	0.38	0.38	0.38
Maximum Solar Heat Gain Coefficient (SHGC) ³	NR	NR	0.40	NR	NR	0.40	0.40	0.40	0.40	0.40	0.40
Maximum total area	14%	14%	14%	16%	14%	14%	14%	16%	16%	14%	16%
Maximum West facing area	NR	NR	5%	NR	NR	5%	5%	5%	5%	5%	5%
THERMAL MASS⁴	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
SPACE-HEATING⁵											
Electric-resistant allowed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
If gas, AFUE =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
If heat pump, HSPF ⁶ =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
SPACE-COOLING											
SEER =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
If split system,	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ
Refrigerant charge measurement or thermostatic expansion valve											
DUCTS											
Duct sealing	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
Duct Insulation	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8
WATER-HEATING	System shall meet Section 151 (f) 8 or Section 151 b										

STANDARDS TABLE 151-C ALTERNATIVE COMPONENT PACKAGE D

Climate Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
BUILDING ENVELOPE																
Insulation minimums ¹																
Ceiling	R38	R30	R30	R30	R30	R30	R30	R30	R30	R30	R38	R38	R38	R38	R38	R38
Wood-frame walls	R21	R13	R13	R13	R13	R13	R13	R13	R13	R13	R19	R19	R19	R21	R21	R21
"Heavy mass" walls	(R4.76)	(R2.44)	(R2.44)	(R2.44)	(R2.44)	(R2.44)	(R2.44)	(R2.44)	(R2.44)	(R2.44)	(R4.76)	(R4.76)	(R4.76)	(R4.76)	(R4.76)	(R4.76)
"Light mass" walls	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Below-grade walls	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0	R13
Slab floor perimeter	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	R7
Raised floors	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19	R19
Concrete raised floors	R8	R8	R0	R0	R0	R0	R0	R0	R0	R0	R8	R4	R8	R8	R4	R8
Radiant Barrier	NR	REQ	NR	REQ	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
FENESTRATION																
Maximum U-factor ²	0.57	0.57	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.57	0.57	0.57	0.57	0.57	0.57	0.55
Maximum Solar Heat Gain Coefficient (SHGC) ³	NR	0.40	NR	0.40	NR	NR	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	NR
Maximum total area	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Maximum West facing area	NR	5%	NR	5%	NR	NR	5%	5%	5%	5%	5%	5%	5%	5%	5%	NR
THERMAL MASS⁴	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
SPACE-HEATING⁵																
Electric-resistant allowed	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
If gas, AFUE =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
If heat pump, HSPF ⁶ =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
SPACE-COOLING																
SEER =	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
If split system,	NR	REQ ⁹	NR	NR	NR	NR	NR	REQ ⁹	REQ ⁹	REQ ¹²	REQ ¹²	REQ ¹²	REQ ¹³	REQ ¹⁴	REQ	NR
Refrigerant charge measurement or Thermostatic Expansion valve																
DUCTS																
Duct sealing	REQ ⁸	REQ ⁹	REQ ¹⁰	REQ ¹¹	REQ ¹⁰	REQ ¹⁰	REQ ¹⁰	REQ ⁹	REQ ⁹	REQ ¹²	REQ ¹²	REQ ¹²	REQ ¹³	REQ ¹⁴	REQ	REQ ⁸
Duct Insulation	R-6	R-6	R-6	R-6	R-6	R-4.2	R-4.2	R-4.2	R-6	R-6	R-6	R-6	R-6	R-8	R-8	R-8
WATER-HEATING System shall meet Section 151 (f) 8 or Section 151 b																

Notes to Standards Tables 151-B and 151-C

1. The R-values shown for ceiling, wood frame wall and raised floor are for wood-frame construction with insulation installed between the framing members. For alternative construction assemblies, see Section 151 (f) 1 A. The heavy mass wall R-value in parentheses is the minimum R-value for the entire wall assembly if the wall weight exceeds 40 pounds per square foot. The light mass wall R-value in brackets is the minimum R-value for the entire assembly if the heat capacity of the wall meets or exceeds the result of multiplying the bracketed minimum R-value by 0.65. Any insulation installed on heavy or light mass walls must be integral with, or installed on the outside of, the exterior mass. The inside surface of the thermal mass, including plaster or gypsum board in direct contact with the masonry wall, shall be exposed to the room air. The exterior wall used to meet the R-value in parentheses cannot also be used to meet the thermal mass requirement.
2. The installed fenestration products shall meet the requirements of §151 (f) 3 and §151 (f) 4.
3. The installed fenestration products shall meet the requirements of Section 151 (f) 4.
4. If the package requires thermal mass, the thermal mass shall meet the requirements of Section 151 (f) 5.
5. Automatic setback thermostats shall be installed in conjunction with all space-heating systems in accordance with Section 151 (f) 9.
6. HSPF means "heating seasonal performance factor."
7. Electric-resistance water heating may be installed as the main water heating source in Package C only if the water heater is located within the building envelope and a minimum of 25 percent of the energy for water heating is provided by a passive or active solar system or a wood stove boiler. A wood stove boiler credit shall not be used in Climate Zones 8, 10, and 15, nor in localities that do not allow wood stoves.
8. As an alternative under Package D in climate zones 1 and 16, glazing with a maximum 0.42 U-factor and a 90% AFUE furnace or a 7.6 HSPF heat pump may be substituted for duct sealing. All other requirements of Package D must be met.
9. As an alternative under Package D in climate zones 2, 8, and 9, glazing with a maximum 0.38 U-factor and maximum 0.31 SHGC may be substituted for duct sealing and either refrigerant charge measurement or a thermostatic expansion valve. All other requirements of Package D must be met.
10. As an alternative under Package D in climate zones 3, 5, 6 and 7, glazing with a maximum 0.42 U-factor may be substituted for duct sealing. All other requirements of Package D must be met.
11. As an alternative under Package D in climate zone 4, glazing with a maximum 0.38 U-factor and maximum 0.36 Solar Heat Gain Coefficient may be substituted for duct sealing. All other requirements of Package D must be met.
12. As an alternative under Package D in climate zones 10, 11, and 12, glazing with a maximum 0.38 U-factor and maximum 0.31 Solar Heat Gain Coefficient, and a minimum 13.0 SEER space cooling system may be substituted for duct sealing and either refrigerant charge measurement or a thermostatic expansion valve. All other requirements of Package D must be met.
13. As an alternative under Package D in climate zone 13, glazing with a maximum 0.38 U-factor and maximum 0.31 Solar Heat Gain Coefficient, and a minimum 15.0 SEER space cooling system may be substituted for duct sealing and either refrigerant charge measurement or a thermostatic expansion valve. All other requirements of Package D must be met.
14. As an alternative under Package D in climate zone 14, glazing with a maximum 0.38 U-factor and maximum 0.31 Solar Heat Gain Coefficient, and a minimum 16.0 SEER space cooling system may be substituted for duct sealing and either refrigerant charge measurement or a thermostatic expansion valve. All other requirements of Package D must be met.

STANDARDS SECTION 152 (a) and 152 (b)

- (a) **Additions.** Additions to existing residential buildings shall meet the requirements of Sections 111 through 118, Section 119 (d), and Section 150, and either Section 152 (a) 1 or 2.
1. **Prescriptive approach.** Additions to existing buildings shall meet the following additional requirements:
 - A. Fenestration in additions up to 100 square feet shall not have more than 50 square feet of fenestration area, and shall meet the U-factor and Solar Heat Gain Coefficient requirements of Package D (Sections 151 (f) 3 A, 151 (f) 4 and **STANDARDS TABLE 151-C**); or
 - B. Additions up to 1000 square feet shall meet all the requirements of Package D [Section 151(f) and **STANDARDS TABLE 151-C**], except that the addition's total glazing area limit is the maximum allowed in Package D plus the glazing area that was removed by the addition, and the wall insulation value need not exceed R-13.
 - C. Additions of more than 1000 square feet shall meet all the requirements of Package D [Section 151(f) and **STANDARDS TABLE 151-C**].
 2. **Performance approach.** Performance calculations shall meet the requirements of Section 151 (a) through (e), pursuant to either Item A or B, below.
 - A. The addition complies if the addition alone meets the combined water-heating and space-conditioning energy budgets.
 - B. The addition complies if the energy efficiency of the existing building is improved such that the TDV energy consumption of the improved existing building and the addition is equal to or less than that of the unimproved existing building plus an addition that complies with the applicable energy budget. When an improvement is proposed to the existing building to comply with this subsection, the improvement shall meet the requirements of Section 152 (b) 2 for that component.

EXCEPTION 1 to Section 152 (a): Existing structures with R-11 framed walls showing compliance with Section 152 (a) 2 (Performance Approach) are exempt from Section 150 (c).

EXCEPTION 2 to Section 152 (a): Any dual-glazed greenhouse window and dual-glazed skylight installed in an addition complies with the U-factor requirements in Section 151 (f) 3 A.

EXCEPTION 3 to Section 152 (a): If the addition will increase the total number of water heaters in the building, one of the following types of water heaters may be installed to comply with Section 152 (a) 1 or Section 152 (a) 2 A:

1. A gas storage nonrecirculating water-heating system that does not exceed 50 gallons capacity; or

2. If no natural gas is connected to the building, an electric storage water heater that does not exceed 50 gallons capacity, and has an energy factor not less than 0.90; or

3. A water-heating system determined by the executive director to use no more energy than the one specified in Item 1 above; or if no natural gas is connected to the building, a water-heating system determined by the executive director to use no more energy than the one specified in Item 2 above.

For prescriptive compliance with Section 152 (a) 1, the water-heating systems requirement in Section 151 (f) 8 shall not apply. For performance compliance for the addition alone, only the space-conditioning budgets of Section 151 (b) 2 shall be used; the water-heating budgets of Section 151 (b) 1 shall not apply.

The performance approach for the existing building and the addition in Section 152 (a) 2 B may be used to show compliance, regardless of the type of water heater installed.

EXCEPTION 4 to Section 152 (a): When heating and/or cooling will be extended to an addition from the existing system(s), the existing heating and cooling equipment need not comply with Title 24, Part 6. The heating system capacity must be adequate to meet the minimum requirements of CBC Section 310.11.

EXCEPTION 5 to Section 152 (a): When ducts will be extended from an existing duct system to serve the addition, the ducts shall meet the requirements of Section 152 (b) 1 D.

(b) **Alterations.** Alterations to existing residential buildings or alterations in conjunction with a change in building occupancy to a low-rise residential occupancy shall meet either Item 1 or 2 below.

1. **Prescriptive approach.** The altered component and any newly installed equipment serving the alteration shall meet the applicable requirements of Sections 110 through 118, Section 119 (d), and Section 150; and

A. Alterations that add fenestration area shall meet the U-factor requirements of Package D [Section 151 (f) 3 A and **STANDARDS TABLE 151-C**], the total fenestration area requirements of Package D [Section 151 (f) 3 B and **STANDARDS TABLE 151-C**], and the Solar Heat Gain coefficient requirements of Package D [Section 151 (f) 4 and **STANDARDS TABLE 151-C**]

EXCEPTION to Section 152(b) 1 A.: Alterations that add fenestration area of up to 50 square feet shall not be required to meet the total fenestration area requirements of Section 151 (f) 3. B.

B. Replacement fenestration, where all the glazing in an existing fenestration opening is replaced with a new manufactured fenestration product, shall not exceed the U-factor and Solar Heat Gain Coefficient requirements of Package D [Sections 151 (f) 3 A and 151 (f) 4 and **STANDARDS TABLE 151-C**].

NOTE: Glass replaced in an existing sash and frame, or replacement of a single sash in a multi-sash fenestration product are considered repairs.

- C. New space-conditioning systems or components other than new or replacement space conditioning ducts shall:
 - i. Meet the requirements of Section s150 (h), 150 (i), 150 (j) 2, 151 (f) 7, and 151 (f) 9; and
 - ii. Be limited to natural gas, liquefied petroleum gas, or the existing fuel type unless it can be demonstrated that the TDV energy use of the new system is more efficient than the existing system.
 - D. When more than 40 feet of new or replacement space-conditioning ducts are installed in unconditioned space, the new ducts shall meet the requirements of Section 150 (m) and the duct insulation requirements of Package D Section 151 (f) 10, and if in climate zones 2, 9, 10, 11, 12, 13, 14, 15, or 16, the duct system shall be sealed as confirmed through field verification and diagnostic testing in accordance with procedures for duct sealing of existing duct systems as specified in the Residential ACM manual, to meet one of the following requirements:
 - i. If the new ducts form an entirely new duct system directly connected to the air handler, the measured duct leakage shall be less than 6% of fan flow; or
 - ii. If the new ducts are an extension of an existing duct system, the combined new and existing duct system shall meet one of the following requirements:
 - a. The measured duct leakage shall be less than 15% of fan flow; or
 - b. The measured duct leakage to outside shall be less than 10% of fan flow; or
 - c. The duct leakage shall be reduced by more than 60% relative to the leakage prior to the installation of the new ducts and a visual inspection including a smoke test shall demonstrate that all accessible leaks have been sealed or
 - d. If it is not possible to meet the duct sealing requirements of Subsection a, b, or c, all accessible leaks shall be sealed and verified through a visual inspection and a smoke test by a certified HERS rater.
- EXCEPTION to Section 152 (b) 1 D ii:** Existing duct systems that are extended, which are constructed, insulated or sealed with asbestos.
- E. In climate zones 2, 9, 10, 11, 12, 13, 14, 15, and 16, when a space-conditioning system is altered by the installation or replacement of space-conditioning equipment (including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, cooling or heating coil, or the furnace heat exchanger) the duct system that is connected to the new or replacement space-conditioning equipment shall be sealed, as confirmed through field verification and diagnostic testing in accordance with procedures for duct sealing of existing duct systems as specified in the Residential ACM manual, to one of the following requirements.
 - i. The measured duct leakage shall be less than 15% of fan flow; or

- ii. The measured duct leakage to outside shall be less than 10% of fan flow; or
- iii. The measured duct leakage shall be reduced by more than 60% relative to the measured leakage prior to the installation or replacement of the space conditioning equipment and a visual inspection including a smoke test shall demonstrate that all accessible leaks have been sealed; or
- iv. If it is not possible to meet the duct requirements of i, ii, or iii, all accessible leaks shall be sealed and verified through a visual inspection and a smoke test by a certified HERS rater.

EXCEPTION 1 to Section 152 (b) 1 E: Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in the Residential ACM manual.

EXCEPTION 2 to Section 152 (b) 1 E: Duct systems with less than 40 linear feet in unconditioned spaces.

EXCEPTION 3 to Section 152 (b) 1 E: Existing duct systems constructed, insulated or sealed with asbestos.

F. New service water-heating systems or components shall:

- i. Meet the requirements of Section 150; and
- ii. Be limited to natural gas, liquefied petroleum gas, or the existing fuel type unless it can be demonstrated that the TDV energy use of the new system is more efficient than the existing system.

2. Performance approach.

- A. The altered components shall meet the applicable requirements of Sections 110 through 118, Section 119 (d), and Section 150; and
- B. The energy efficiency of the existing building shall be improved so that the building meets the energy budget in Section 151 that would apply if the existing building was unchanged except that those altered components that do not meet the requirements of Section 152 (b) 1 (including improvements proposed to comply with this section) are assumed to be upgraded to comply with Section 152 (b) 1 as specified in the Residential ACM Manual.

EXCEPTION 1 to Section 152 (b): The EXCEPTION to Section 150 (k) 2 applies only for alterations to kitchen lighting where all permanently installed kitchen luminaires are replaced.

EXCEPTION 2 to Section 152 (b): Any dual-glazed greenhouse window and dual-glazed skylight installed as part of an alteration complies with the U-factor requirements in Section 151 (f) 3 A.

Residential Table – Vintage Table Values

TABLE R3-11 – DEFAULT ASSUMPTIONS FOR EXISTING BUILDINGS – VINTAGE TABLE VALUES

		Default Assumptions for Year Built (Vintage)							
Conservation Measure		Before 1978	1978 to 1983	1984 to 1991	1992 to 1998	1999 - 2000	2001- 2003	2004- 2005	2006 and Later
INSULATION U-FACTOR									
Roof		0.079	0.049	0.049	0.049	0.049	0.049	0.049	0.049
Wall		0.356	0.110	0.110	0.102	0.102	0.102	0.102	0.102
Raised Floor—CrawlSp		0.099	0.099	0.099	0.046	0.046	0.046	0.046	0.046
Raised Floor-No CrawlSp		0.238	0.238	0.238	0.064	0.064	0.064	0.064	0.064
Slab Edge	F-factor =	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Ducts		R-2.1	R-2.1	R-2.1	R-4.2	R-4.2	R-4.2	R-4.2	R-4.2
LEAKAGE									
Building (SLA)		4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Duct Leakage Factor (See Table 4-13)		0.86	0.86	0.86	0.86	0.86	0.89	0.89	0.89
FENESTRATION									
U-factor		Use Table 116-A - Title 24, Part 6, Section 116 for all Vintages							
SHGC		Use Table 116-B - Title 24, Part 6, Section 116 for all Vintages							
Shading Dev.		Use Table R3-7 for all Vintages							
SPACE HEATING EFFICIENCY									
Gas Furnace (Central) AFUE		0.75	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Gas Heater (Room) AFUE		0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Heat Pump	HSPF	5.6	5.6	6.6	6.6	6.8	6.8	6.8	7.4
Electric Resistance HSPF		3.413	3.413	3.413	3.413	3.413	3.413	3.413	3.413
SPACE COOLING EFFICIENCY									
All Types,	SEER	8.0	8.0	8.9	9.7	9.7	9.7	9.7	12.0
WATER HEATING									
Energy Factor		0.525	0.525	0.525	0.525	0.58	0.58	0.575	0.575
Rated Input, MBH		28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0

Appliance Efficiency Standards

Table F-3 Standards for Large Water Heaters

Table F-3
Standards for Large Water Heaters
(New Standards Effective October 29, 2003)

<i>Appliance</i>	<i>Category</i>	<i>Size or Rating</i>	<i>Minimum Thermal Efficiency (%)</i>	<i>Maximum Standby Loss^{1,2}</i>
Gas storage water heaters	< 4,000 Btu/hr/gal	≤ 155,000 Btu/hr	80	$Q/800 + 110\sqrt{V}$ Btu/hr
		> 155,000 Btu/hr	80	$Q/800 + 110\sqrt{V}$ Btu/hr
Gas instantaneous water heaters	≥ 4,000 Btu/hr/gal	≥ 10 gal	80	$Q/800 + 110\sqrt{V}$ Btu/hr
Oil storage water heaters	< 4,000 Btu/hr/gal	≤ 155,000 Btu/hr	78	$Q/800 + 110\sqrt{V}$ Btu/hr
		> 155,000 Btu/hr	78	$Q/800 + 110\sqrt{V}$ Btu/hr
Oil instantaneous water heaters	≥ 4,000 Btu/hr/gal	< 10 gal	80	—
		≥ 10 gal	78	$Q/800 + 110\sqrt{V}$ Btu/hr
Gas hot water supply boilers	≥ 4,000 Btu/hr/gal	≥ 10 gal	80	$Q/800 + 110\sqrt{V}$ Btu/hr
Oil hot water supply boilers	≥ 4,000 Btu/hr/gal	≥ 10 gal	78	$Q/800 + 110\sqrt{V}$ Btu/hr
Electric water heaters	All	All	No requirement	$0.30 + 27/V$ % Per hour

¹ Standby loss is based on a 70° F temperature difference between stored water and ambient requirements. In the standby loss equations, V is the rated volume in gallons, and Q is the nameplate input rate in Btu/hr.

² Water heaters and hot water supply boilers having more than 140 gallons of storage capacity are not required to meet the standby loss requirement if the tank surface is thermally insulated to R-12.5, if a standing pilot light is not installed, and for gas- or oil-fired storage water heaters, there is a flue damper or fan-assisted combustion.

Table F-4
Standards for Large Water Heaters
(Existing Standards Remaining in Effect On and After October 29, 2003)

<i>Fuel</i>	<i>Input Rating</i>	<i>Volume (gallons)</i>	<i>Input to Volume Ratio (Btu/gal)</i>	<i>Minimum Thermal Efficiency (%)</i>	<i>Maximum Standby Loss (%/hour)^{1,2}</i>
Gas	> 200,000 (Btu/hour)	< 10	≥ 4,000	80	Not applicable
Electric	> 12 kW	≤ 140	< 4,000	Not applicable	$0.3 + 27/V$
Electric	> 12 kW	> 140	< 4,000	Not applicable	$0.3 + 27/V$
Electric	> 12 kW	< 10	≥ 4,000	80	Not applicable
Electric	> 12 kW	≥ 10	≥ 4,000	77	$2.3 + 67/V$

¹ Volume (V) = measured storage volume in gallons

² Storage-type water heaters with volume exceeding 140 gallons need not meet the standby loss requirement if they are thermally insulated to at least R-12.5 and a standing pilot light is not used.